3.1.3 AFCEE Requirements for Evaluation of Vapor Intrusion into Indoor Air

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Introduction

The guidance released by the U.S. Environmental Protection Agency (EPA) (2002) provides a consistent method to both the responsible parties of contaminated sites and regulatory agencies to evaluate the vapor intrusion pathway. The method facilitates demonstration of due diligence when assessing the vapor intrusion pathway for completeness and the associated risks to indoor receptors. The approach presented in the EPA guidance is a tiered series of evaluations; each is used to determine whether further evaluation or immediate action is warranted or whether the pathway can be removed from further consideration. Should the vapor intrusion pathway be found to be complete, the estimated or measured vapor concentrations are used to estimate risks to the residents or occupants of the affected buildings.

A complicating factor in evaluating the risk from vapor intrusion of site-related chemicals into indoor air is the potential presence in the building air of some of the same chemicals from background sources (e.g., ambient air contaminants or sources in the buildings such as household solvents/cleaners and fuels). This situation can generate misleading results because it is difficult—sometimes impossible—to eliminate or adequately account for contributions from background sources (U.S. EPA, 2002). Therefore, indoor air sampling is conducted only if it is necessary to confirm modeled estimates of contaminant concentrations or when there is a potential for direct release of site-related vapors into indoor air (such as from basement sumps containing contaminated groundwater).

AFCEE Requirements

The vapor intrusion into indoor air pathway must be considered when evaluating the potential risks posed by site contaminants. A phased approach will be used to evaluate (1) the potential for site-related vapors to intrude into nearby buildings and (2) the resulting risk if the pathway is complete. Each phase—or step within a phase—of the evaluation will be governed by a work plan that is based on an up-to-date conceptual site model (CSM) and data quality objectives (DQOs) specific to the evaluation step being planned.

If at any phase—or step within a phase—a determination is made that the subsurface-to-indoor air pathway is incomplete, the evaluation leading to that determination will be documented. Documentation will include details of the investigation of potential contaminant-transport-augmentation factors, such as seasonal conditions and underground utility corridors.

If the subsurface-to-indoor air pathway is potentially complete, the DQO process will be followed rigorously to plan the risk assessment effort(s) and to ensure that the required data are collected to make technically sound risk-based decisions. The effort(s) will be comprehensively documented, and the risk assessment(s) will include a risk characterization that considers cumulative risk to residents and occupants via all exposure

pathways and includes a comprehensive uncertainty analysis (U.S. EPA, 2000; Hers *et al.*, 2003). If indoor air sampling is required, the work plan for these efforts will be developed based on existing guidance (MA DEP, 2002; U.S. EPA, 2002) to ensure that the results are technically defensible. If a baseline risk assessment has already been submitted to the regulatory agencies before the indoor air risk assessment is completed, the documentation of the indoor air evaluation will be prepared for submittal to the regulatory agencies as a stand alone risk assessment document.

If, during any phase of the evaluation, buildings are identified that potentially warrant immediate action, the AFCEE Project Manager and the installation Remedial Project Manager will be notified immediately. These notifications and any actions taken will be documented in letters to both managers.

Recommended Practices and Guidance

A phased approach should be used to evaluate the potential for subsurface vapors to intrude into indoor air and pose an inhalation risk. The phased approach is necessary because there are several points in the process where substantive decisions must be made concerning whether additional evaluation is needed. Three major phases are recommended: (1) the pathway evaluation phase, (2) the media-to-media transfer evaluation phase, and (3) the confirmation phase. During all phases of investigation the individuals conducting the work should be mindful of conditions that would warrant immediate action (e.g., resident reports of headaches/dizziness, contaminant odors, potential explosive hazards) and immediately contact the appropriate parties to ensure that necessary protective action is taken.

The pathway evaluation phase should be limited to determining (1) whether the pathway for the migration of site-related subsurface contaminants into the indoor air of nearby buildings is potentially complete and (2) whether current conditions warrant immediate action. This first phase can be completed when general knowledge of the site is sufficient to develop a CSM and to know or reasonably suspect that site-related contaminants of potential indoor air concern are present in the subsurface (U.S. EPA, 2002). During this evaluation phase, diligence is needed to ensure comprehensive investigation of factors that could enhance the transport of contaminated media toward indoor receptors (e.g., utility conduits and seasonal water table fluctuations). The report on this phase should clearly demonstrate either that the pathway is not complete or that it is potentially complete.

The initial effort in the media-to-media transfer evaluation phase should be to evaluate the potential for unacceptable indoor air concentrations of chemicals of potential (COPCs) by comparing measured or reasonably estimated media concentrations to screening concentrations available from selected guidance documents (such as U.S. EPA, 2002). If the measured or reasonably estimated media concentrations do not exceed the screening concentrations, this information should be included in the risk assessment for the site. If a baseline risk assessment has already been submitted to the regulatory agencies, the documentation of the indoor air evaluation should be prepared for submittal to the regulatory agencies as a stand alone document.

If the site media concentrations of contaminants of potential indoor air concern are greater than the screening concentrations, an additional media-to-media transfer

evaluation is conducted. To the extent possible, this effort should incorporate site-specific information into the model used to estimate indoor air concentrations of contaminants (Johnson and Ettinger, 1991; U.S. EPA, 2000). Such site-specific information includes—but is not limited to—spatial characteristics of the contaminated medium and building foundation, soil characteristics, and building structural and air handling characteristics (Hers *et al*., 2003). This step should produce estimates of sub-foundation soil gas and indoor air concentrations of COPCs, as well as an indication of whether intruded vapors of COPCs pose an unacceptable risk. The risk determination is made by comparing the calculated indoor air concentrations to published risk-based concentrations (e.g.: U.S. EPA, 2002; U.S. EPA Region IX, 2002) or is based on calculated risk estimates. In either case, the risk determination is presented as a risk characterization that includes a comprehensive uncertainty analysis (Hers *et al*., 2003; U.S. EPA, 2000).

The confirmation phase is initiated in cases where the results of the media-to-media transfer evaluation indicate that indoor air concentrations of COPCs may pose an unacceptable risk or when the results are equivocal. In these cases, the concentrations of COPCs in sub-foundation soil gas, or as a last option in indoor air, need to be evaluated. This DQO-guided evaluation should focus on confirming the concentrations of COPCs calculated in the media-to-media evaluation phase. The results of this evaluation are presented as a risk characterization that includes a comprehensive uncertainty analysis (Hers *et al*., 2003; U.S. EPA, 2000).

Because of the complications associated with sampling indoor air and distinguishing the contribution of background concentrations to the total indoor air concentration of COPCs, sampling of indoor air should be conducted only if remediation decisions cannot be made without such an evaluation. Sampling of indoor air will likely be required when preferential pathways exist for vapor intrusion into building, such as sumps or wet basements.

References

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